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Indigenous Knowledge Assessment on Irrigation Water Management Practices at Jimma Zone, Ethiopia

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Abstract

This study was aimed to investigate farmers' current irrigation water management practice and their technical performance. The study used reconnaissance survey and observations were carried out with each Woreda Bureau of Agriculture to obtain overview of different irrigation schemes and irrigation practice conditions. The collected qualitative and quantitative data were analyzed using appropriated statistical method IBM SPSS version 26. The total number of respondents was 122 which were selected based on local conditions from seven (7) woreda irrigation schemes of Jimma zone. The study result showed that farmers have developed several indigenous knowledge of irrigation water management practice. Based on their knowledge, 73.77% of farmers use furrow irrigation method; 3.28% of them used flood irrigation; 5.74% irrigated their farm with water can and farmers use soil moisture method and crop leaf wilt techniques to irrigate their crop. The farmers apply irrigation water at morning and night time, 89.34% respondents' uses optimum/medium amount of water to irrigate by their own traditional ways even with the furrow irrigation methods. In addition to that, 95.9% of the farmers of these different areas were replayed the problems of high amount of water for the crops and soil of the irrigation field. Therefore, good management of irrigation water controlled the crop as well as the soil from different outbreak of diseases and soil erosion respectively. Finally, to make the indigenous knowledge more actual farmers should be assisted either by governmental or other non-governmental organizations providing improved agricultural technologies and better access.

Keywords: Indigenous knowledge • Small scale • Water management and irrigation practice • Irrigation water

Introduction

Irrigation serves as a cultural and social tool that can help a society develop along a desired trajectory. In the era of the green revolution, irrigation served as the keystone of agricultural growth and investments were justified in economic terms but which also had far-reaching social and cultural impacts. These ancillary impacts of irrigation development were generally viewed as desirable for creating a modern society as subsistence farmers shifted to higher value crops and were drawn more firmly into the market economy. Irrigation development has a unique role to play in helping indigenous communities meet their cultural objectives because of its blend of economic and socio-cultural impacts. Irrigation has a positive and significant impact on household food security. Consequently, concerned bodies that working on small-scale irrigation development should continue investment in irrigation. Traditional irrigation system has been practiced in the highlands of Konso (Ethiopia) for centuries. The traditional small scale irrigation is simple water diversions. It is very old practice in Ethiopia and has been in use for decades in the highlands where small scale farmers could divert river, spring water seasonally for a limited dry season cropping [1].

Understanding the community culture is essential for finding sustainable solutions for natural resource problems, such as water resources. Indigenous knowledge in agriculture can improve the water crisis situation and alleviate water stress from dry and semi-arid areas. Indigenous knowledge is the local or traditional knowledge system used by farmers. Therefore indigenous knowledge on irrigation water management means using of local or traditional knowledge system to manage irrigation water [2].

Indigenous knowledge is the unique knowledge confined to a particular culture or society. This knowledge is generated and transmitted by communities, over time, in an effort to cope with their own agro-ecological and socio-economic environments. Indigenous knowledge is the basis for local level decision-making in food security, human and animal health, education, natural resource management and other vital economic and social activities. Therefore, this study was carried

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out to assess irrigation practice under small scale farmer's; to identify farmers technical perception assessment towards irrigation water management practice and to determine the indigenous knowledge on irrigation water management different areas of the Jimma zone [3].

Materials and Methods

Description of the study area

The survey was conducted at Dedo, Gomma, Omo-Nada, Kersa, Limu-Seka, Seka-Chekorsa, and Shabe-Sombo which are some woreda's of Jimma zone where smallholder farmers practice traditional irrigation activities. Jimma zone is located 350 km away from Addis Ababa the capital city of Ethiopia. It is geographically located between 35° 40' E to 37° 40' E longitudes and 7° 10' N to 8° 50' N latitude as indicated on the map and the altitude of the zone ranges from 880 m.a.s.l to 3340 m.a.s.l. The woredas was selected based on their irrigation practice experience and availability of irrigation schemes (Figure 1).

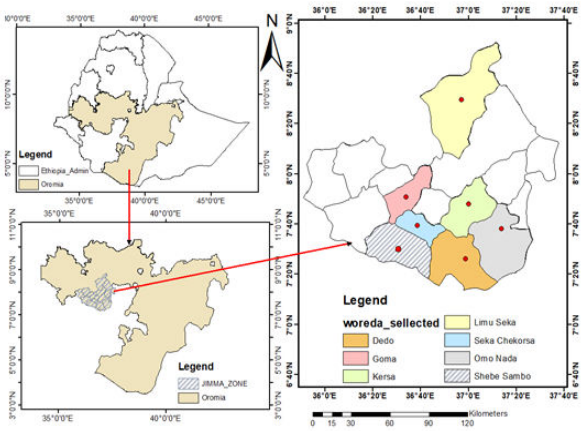

Figure 1. Locations of the study area.

Data collection

A reconnaissance survey and observation was carried out with overview of different irrigation schemes and irrigation practice conditions. Based on the reconnaissance survey and observation survey area was selected and appropriate semi-structured survey questionnaire was prepared for different schemes and community. The assessment was to include survey questionnaire interview for different users including all level of community and with gender inclusion using stratified random sampling technique. Total number of household to be interviewed and number of areas (schemes) was set based on the local condition [4].

Data analysis

Based on these questioner primary data was collected for the study. The collected qualitative and quantitative data from primary sources was analyzed using appropriated statistical methods SPSS.

Results and Discussion

To identify the current and the best indigenous irrigation water management practices under small scale farmer's condition of Jimma zone, the qualitative data were used for the analysis. Stratified random sampling technique was employed to select the respondents [5].

Demographic characteristics of the respondents

Out of the total 122 respondents, 110 (90.2%) of them were males and 12 (9.8%) were females. Fifty of them or forty one percent 50 (41.0%) were illiterate, 46.7% received formal education from primary school up to college level and the rest 12.3% of them were read and write with informal education. About 95.1% of respondents were at the age of 15-65 only 4.9% of them are above 65 years old. This indicates respondents were with high potential age of working on farm as comprehend from their responses. Young farmers are more productive than their older counterparts (Table 1) [6].

Gender	Frequency	Percent
Male	110	90.2
Female	12	9.8
Total	122	100
Age of household head		
15-65	116	95.1
Greater than 65	6	4.9
Total	122	100
Educational background		
Illiterate	50	41

Read and write	15	12.3
Primary	48	39.3
Secondary	8	6.6
College and above	1	0.8
Total	122	100

Table 1. Demographic characteristics.

Irrigation practice under small scale farmer's

From the total one hundred of the farmers have their own land and five farmers were rented in from others, the remaining were both rented in and out as indicated in the following Table 2. This indicates that most of the areas of the scheme were irrigated by land owned farmers [7].

No.	Woreda	Land ownership				Total
		Owned	Rented in	Owned and rented out	Owned and rented in	
1	Dedo	14	1	2	3	20
2	Gomma	5	3	0	1	9
3	Omo Nada	8	0	0	3	11
4	Kersa	13	0	0	3	16
5	Limu Seka	30	0	1	1	32
6	Seka Chekorsa	12	0	0	0	12
7	Shabe Sombo	18	1	0	3	22
Total		100	5	3	14	122

Table 2. Type of land ownership.

The owned irrigation land around 59.84% of the farmers area were less than 0.5 ha and 33.61% of the farmers irrigated land were up to one hectare and the remaining 6.56% of the farmers irrigated land were up to two hectare as discussed in Table 3. Generally, there was a practice of small scale farming in the Jimma zone. Traditional irrigation schemes built through self-help program carried out by farmers on their own creativity and varies from less than 50 ha to 100 ha.

No.	Woreda	Own irrigated land				Total
		Less than 0.5 ha	0.5 ha to 1 ha	1 ha to 2 ha	Greater than 2 ha	
1	Dedo	9	7	2	2	20
2	Gomma	5	4	0	0	9
3	Omo Nada	2	8	1	0	11
4	Kersa	14	0	2	0	16
5	Limu Seka	16	15	1	0	32
6	Seka Chekorsa	11	1	0	0	12
7	Shabe Sombo	16	6	0	0	22
Total		73	41	6	2	122

Table 3. Own irrigation land in hectare.

Farmers technical perception assessment towards irrigation water management practice

The method of irrigation which was practiced by 73.77% of the farmers were furrow irrigation; 3.28% of them used flood irrigation; 5.74% irrigated their farm with water can and the remaining 17% were used to practice combinations of irrigation methods as listed in Table 4. There was no drip and sprinkler irrigation methods used in all woredas [8].

No.	Woreda	Method of irrigation used				Total
		Furrow	Flood	Watering can	Combination	
1	Dedo	15	0	3	2	20
2	Gomma	8	0	0	1	9
3	Omo Nada	11	0	0	0	11
4	Kersa	14	0	0	2	16
5	Limu Seka	21	4	1	6	32
6	Seka Chekorsa	10	0	0	2	12
7	Shabe Sombo	11	0	3	8	22
Total		90	4	7	21	122

Table 4. Methods of irrigation used.

The amounts of water deliver to irrigation farms were controlled by different methods of practice which are small channels, pumps and other traditional methods. However, 31.15% of the farmers respond that they weren't practiced any water delivery control mechanisms.

There was a respectable practice of using a water pump on the irrigation schemes which was implemented by 50% of the respondents and the remaining farmers were used water can and furrows to deliver irrigation water to their field (Table 5) [9].

No.	Woreda	How to control amount of water delivery				Total
		Small channel	Not controlled	Using pump	Traditionally	
1	Dedo	2	9	6	3	20
2	Gomma	0	2	2	5	9
3	Omo Nada	2	5	2	2	11
4	Kersa	1	3	6	6	16
5	Limu Seka	15	6	9	2	32
6	Seka Chekorsa	1	2	9	0	12
7	Shabe Sombo	0	10	2	10	22
Total		20	38	36	28	122

Table 5. Water delivery amount.

Based on the general know how of the respondents medium amount (neither large amount nor small amount) of water application to the field leads to get maximum yield from crops. This was what an irrigation experts call it optimum amount of irrigation water. Therefore 89.34% of the respondents were agreed to that of the application of medium amount of water as indicated on Table 6.

No.	Woreda	Mechanisms used for irrigation water delivery and management			Total
		Hose	Pump	Water can and furrow	
1	Dedo	0	13	7	20
2	Gomma	0	0	9	9
3	Omo Nada	0	6	5	11
4	Kersa	0	11	5	16
5	Limu Seka	1	8	23	32

6	Seka Chekorsa	0	3	9	12
7	Shabe Sombo	0	20	2	22
Total		1	61	60	122

Table 6. Mechanisms used for irrigation water delivery.

Generally, the farmers technical perception towards irrigation water management practice of the Jimma zone was practiced based on the farmers indigenous know how and with their long years of experience in irrigation (Table 7) [10].

No	Woreda	Which method leads to maximum yield			Total
		Applying large volume of water	Medium amount of water	Small amount of water	
1	Dedo	2	17	1	20
2	Gomma	1	8	0	9
3	Omo Nada	0	11	0	11
5	Kersa	1	15	0	16
6	Limu Seka	5	26	1	32
7	Seka Chekorsa	1	11	0	12
8	Shabe Sombo	1	21	0	22
Total		11	109	2	122

Table 7. Methods of irrigation water use to lead maximum yield.

Indigenous irrigation water management of different area

The indigenous irrigation water management of the respondents of different areas were discussed regarding to priority use of the irrigation water; the relationships of the water and yield; and problems of applying high amount of water on the field. Therefore, 40.98% of the respondents were used the irrigation water for crop production and 35.25% of the respondents used the irrigation water for domestic use based on priority (in addition to production of crops) but only 23.77% of the respondents has different water source for different purposes. This was an indicator for irrigation water loss. In agreement to this farmers are not in the position to manage the irrigation water. Poor irrigation water management associated with water scarcity is the major reason for underperformance of most small-scale irrigation schemes (Table 8) [11].

No	Woreda	Purpose of using irrigation water based on priority			Total
		Crop production	Domestic use	D/t water source for all purposes	
1	Dedo	11	5	7	23
2	Gomma	0	2	7	9
3	Omo Nada	5	6	0	11
4	Kersa	10	6	0	16
5	Limu Seka	9	8	15	32
6	Seka Chekorsa	9	3	0	12
7	Shabe Sombo	9	13	0	22
Total		50	43	29	122

Table 8. Purpose of the irrigation water based on priority.

The relation between water amount and production yield were discussed on Table 9 below on significance 54.1% of the response accepted that of the optimum water application increases the yield of the crop production. Then 13, 8, 7, 9, 3, 11 and 15 farmers from the woredas Dedo, Gomma, Omo Nada, Kersa, Limu Seka, Seka Chekorsa and Shabe Sombo respectively used optimum water to their field. However, from the total 31.14% of

them respond that yield and water amount has a directly proportional to each other that means as water amount increased yield increased and as water amount decreases yield decreased [12].

No	Woreda	Perception regarding water and yield				Total
		Yield increase as water volume increase	Less water less production	Optimum water increase yield	Unknown	
1	Dedo	4	2	13	1	20
2	Gomma	1	0	8	0	9
3	Omo Nada	2	2	7	0	11
4	Kersa	2	2	9	3	16
5	Limu Seka	9	11	3	9	32
6	Seka Chekorsa	0	0	11	1	12
7	Shabe Sombo	1	2	15	4	22
Total		19	19	66	18	122

Table 9. Perceptions regarding water and yield.

And 14.75% don't have any know-how about the relationship of water and yield but they randomly apply water to their field based on the draying of the soil and wilting of the crop leaf. Results are in agreement to the study at Sebeta and Walmera woredas'.

The problems of applying high amount of water to field were caused yield reduction, outbreak of disease, water logging, quality reduction and soil erosion and land degradation 45.9%, 22.13%, 7.38%, 7.38% and 13.11% respectively. But the remaining 4.1% hadn't respond to the problems of applying much water on field crop and soil. Moreover, understandings of the respondents of the different areas of the study on best indigenous irrigation water management were mostly approached to good irrigation practices. In the study areas, there is no scientific irrigation scheduling practices practiced. But farmers schedule their irrigation simply by observing soil moisture conditions and crop conditions. These means, the next irrigation was applied when soil starts cracking and plants start to wilt during sunny day condition (Table 10) [13].

No.	Woreda	Problem of applying much water					Total
		Yield reduction	Outbreak of disease	Water logging	Quality reduction	Soil erosion and land degradation	
1	Dedo	7	7	0	1	0	15
2	Gomma	6	0	0	0	3	9
3	Omo Nada	6	2	1	1	1	11
4	Kersa	8	2	0	4	2	16
5	Limu Seka	12	5	8	3	4	32
6	Seka Chekorsa	1	11	0	0	0	12
7	Shabe Sombo	16	0	0	0	6	22
Total		56	27	9	9	16	117

Table 10. Problems of applying much water to field.

Conclusion

The results of the assessment indicate that most of the farmers have their own indigenous knowledge on irrigation water management. The irrigation under small scale farm was practiced by the farmers of the woreda with small areas of field. But due to the smaller area on the scheme some of the farmers were used to rent in from others and because of the sufficient water on the areas there was no conflict between farmers of the scheme. However, the most of the schemes were built long years ago and then the canals will need to maintained with continuous solution by the government. The other one was the farmer's technical perception towards irrigation water management practice was with a respectable performance. The interviewers responded that, even though drip and sprinkler irrigation systems are the best irrigation method in terms of water saving and production, the systems were not used due to lack of facilities, knowledge and capital of the farmers. So they used optimization of the amount of water to irrigate by their own traditional ways even with the

furrow irrigation methods. This was an indicator for their long years' experience on indigenous knowledge of water management. There was best indigenous irrigation water management at different area which was described by the respondents. Therefore, applications of poor irrigation practice leads to yield reduction, outbreak of disease, water logging, quality reduction and soil erosion and land degradation. The farmers apply irrigation when the soil is dry (soil crack) and/or crop start wiling in order to fulfill the requirement of the crop.

Finally, to make the indigenous knowledge more effective farmers should be assisted by governmental and non-governmental organizations giving training, participate in field days and demonstration, providing improved agricultural technologies and providing better access to credit.

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Conflict of Interests

The authors have not declared any conflict of interests.

References

1. Adeniyi OA. "Marginal Effects of Farmers' Age on their Irrigation Technology Adoption in Poverty Reduction in Kwara State." *Glob J Interdis Soc Sci* 4 (2014): 53-56.
2. Belay, Mengist and Tefferie B. "The Socio Economic and Institutional Factors that Affect Traditional Small Scale Irrigation Activity along Chemoga River, Gozamin Woreda, Amhara Region, Ethiopia."
3. Yohannes, Degol Fissahaye, Ritsema CJ, Solomon J Froebrich and van Dam JC. "Irrigation Water Management: Farmers' Practices, Perceptions and Adaptations at Gumselassa Irrigation Scheme, North Ethiopia." *Agri Water Manag* 191 (2017): 16-28.
4. Groenfeldt, David. "Irrigation Development and Indigenous Peoples." *Int Water Manag Insti* 12 (2005).
5. Mitku, Demeke Tamane and Adamite TF. "Indigenous Knowledge Assessment on Irrigation Water Management Practices in Metekel Zone, North West Ethiopian." *Amer J Manag Sci Eng* 4 (2022): 40-43.
6. Shahraki, Ali Sardar, Panagopoulos T, Ashari HE and Bazrafshan O. "Relationship between Indigenous Knowledge Development in Agriculture and the Sustainability of Water Resources." *Sustainability* 7 (2023): 5665.
7. Li YH. "Research and Practice of Water-Saving Irrigation for Rice in China." In Water Saving Irrigation for Rice: Proceedings of an International Workshop, Wuhan, China. *Int Water Manag Inst* 4 (2001): 56.
8. Shiwenzu, Getamisay. "Rethinking Traditional Irrigation Water Equity in Holetta River, Awash River Basin, Ethiopia." *Sci J Res Rev* 5 (2019): 1-7.
9. Temam, Mohammed and Abebe N. "Indigenous Knowledge Assessment on Irrigation Water Management Practices." *Amer J Manag Sci Eng* 7 (2022): 14-17.
10. Tesfaye, Gizaw, Fikirie K, Debebe Y and Hailu L. "Evaluating Technical Standards of Implemented Soil and Water Conservation Technologies in Jimma Zone, South-Western Ethiopia." *Agri Res Tech* 19 (2019): 556100.
11. Utami AS, Oue H. "Traditional Ecological Knowledge in Irrigation Water Management in Tanah Datar District West Sumatera." *IOP Conf Ser Earth Env Sci* 1059 (2010): 012036.
12. Menon, Ramkumar. "Spontaneous Preterm Birth, a Clinical Dilemma: Etiologic, Pathophysiologic and Genetic Heterogeneities and Racial Disparity." *Acta Obstet Gynecol Scand* 87 (2008): 590-600.
13. Mwansa, Kaindu, Ahmed Y and Vwalika B. "Prevalence and Factors Associated with Spontaneous Preterm Birth at the University Teaching Hospital, Lusaka Zambia." *Med J Zambia* 47 (2020): 48-56.

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